THE INSTITUTE OF PHYSICS
47 BELGRAVE SQUARE, LONDON, S.W.1.

BULLETIN

No. 57 SEPTEMBER, 1954

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NORTHAMPTON POLYTECHNIC

ST. JOHN STREET, LONDON, E.C.1.

DEPARTMENT OF APPLIED PHYSICS

Session 1954-55.

Advanced Evening Lectures.

i. Semi conductors and their applications.
ii. Microwave technique.

These lectures are intended for graduate students and will be given by specialists from University, Government and industrial laboratories.

Further details may be obtained from the Secretary of the Polytechnic.

APPOINTMENTS VACANT

The inclusion of particulars of a vacancy must not be taken to imply that the Institute necessarily approves of the terms offered or that might be offered. Candidates should satisfy themselves that these are satisfactory, and they may always refer to the Institute for advice.

NORTHERN POLYTECHNIC, HOLLOWAY, LONDON, N.7.

The Governing Body invite immediate applications for appointment as **Head of the Physics Department.** Burnham Scale salary —Grade III. Research and teaching experience essential. Form of application, together with full particulars, will be sent on receipt of a stamped, addressed foolscap envelope.

R. H. Currell, A.S.A.A., *Clerk.*

University of Reading. Applications are invited for posts of **research assistants** in the physics department for investigations of semi-conductors (including transistors) and other problems of solid state physics. Vacancies exist for suitable applicants with a research degree in physics and also for those with a good honours degree in physics, who would be encouraged to work for a higher degree. Previous experience of solid state physics is desirable but not essential. Salary, according to qualifications and experience, in the range £375 to £750. Applications, together with the names of two referees, should be sent to the Professor of Physics, Physics Research Laboratories, 78 Upper Redlands Road, Reading, Berks.

British Rayon Research Association. Physicist required, to undertake research on the shrinkage and dimensional stability of fabrics. Applicants should have a Ph.D. or equivalent research experience. Age under 30 preferred. Superannuation under F.S.S.U. Applications, with two recent testimonials, or the names of two referees, should be sent to the Secretary, British Rayon Research Association, Heald Green Laboratories, Wythenshawe, Manchester.

Required, **physicist** with chemical knowledge for work of a specialized metallurgical nature in connection with important new electro-magnetic development. Qualifications are university degree or similar standard and preferably two or three years' industrial experience, while knowledge of powder metallurgy and metallic powder techniques would be an advantage. Because the project is a new one, post offers considerable prospects. Apply in writing to S.M.A., Engineering Department, K.L.G. Factory, Putney Vale, S.W.15.

Applications are invited from **graduate physicists** of honours standard for the research staff of chemical manufacturers near London. The successful applicant would be required to undertake work in well-equipped research laboratories on the properties of inorganic pigments and on physical problems involved in their manufacture.

The position offers wide scope and excellent prospects. Salary will depend on qualifications and experience but will normally be in the range of £500/£900 per annum. A pension scheme is in operation. Reply to Research Controller, Laporte Titanium Limited, Luton.

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THE INSTITUTE OF PHYSICS

No. 57 **BULLETIN** SEPTEMBER, 1954

FIRST YEAR UNIVERSITY PHYSICS COURSES*

I — By K. A. G. MENDELSSOHN, M.A., D.Phil., F.Inst.P., F.R.S.
(*Clarendon Laboratory, Oxford*).

To state the object of a first year course in physics at a university is not difficult. It is simply to introduce the student to the subject at university level. However, two essential things have to be considered here. Firstly, how much physics the student will know when entering upon his university training and secondly, that this first year has to act as a preparation towards a final degree which the student is expected to acquire a few, usually three, years later. This is the essential problem and it can be solved in quite different ways, according to the structure of the university and to the type of qualification which this university thinks the student should ultimately possess.

Since Mr. Weintroub will deal with the conditions in universities not based on the college system, I shall confine myself to the way this problem is dealt with in Oxford, the only university in this country which I know well. Conditions in Cambridge and the arrangement of courses there are somewhat different from those in Oxford but the essential objects of the first year are very much the same.

Before entering on a more detailed discussion, it may be of interest to see how this problem of providing a bridge between school and university is solved in other countries. Some of the big continental universities (and with certain qualifications the same is true for the large American state universities) use an exceedingly simple system of obtaining from a very inhomogeneous entry a homogeneous set of students for the final years. They simply provide excellent introductory lectures covering a whole year which anyone having obtained university entry, and that usually is the final school leaving examination, may attend. There follows a sometimes quite unofficial but highly competitive examination for permission to enter the laboratory courses. Thus, the effort of entering the final physics school is left entirely to the student with the university providing the opportunity but not helping him in any other way. This device eliminates effectively, if brutally, those students who are unsuited for the subject and those who, freed from school discipline, have a tendency to slack.

* Being two papers read at the Education Group Conference on April 13, 1954.

Such a wasteful system is feasible in a type of university where nothing more has to be provided than large lecture rooms. The university which is based on the college system, however, stands at the other end of the scale. Here every student entering who will not, in a rather limited time, pass final examinations constitutes a severe loss. Quite apart from the waste in intensive and individual teaching which he has received, he has taken the place, in a very restricted entry, of another candidate who might have worked with better success. The first consideration of the university will therefore be to allow entry only to those students who appear likely to get through the full university course, and the colleges spend a considerable effort towards this end. Once the student has been accepted, then the first year of teaching becomes vital. Every effort must be made to prepare every single student successfully for the final course.

Most students coming to read physics in Oxford will, after the first year, enter for Honour Moderations in Science which is one of the First Public Examinations. They have to offer three subjects which usually are physics, properties of matter and mechanics (to be called in future mechanical properties of matter) and mathematics. Some may take chemistry or astronomy as one of the subsidiary subjects but this is rare. During this year they receive lectures on the three subjects for three days a week and the remaining two and a half days are spent on the practical course. They also have to attend classes in which they are taught to solve specific problems. In addition each student will spend one hour per week each with his physics tutor and his mathematics tutor.

From the beginning of the academic year 1954 the syllabus for this examination will be somewhat different from the existing one, which means that the old syllabus was considered not completely suitable and also that at this stage one cannot say how the new syllabus will work out in practice. It is perhaps significant that the physicists at Oxford set out to change their first year teaching because they felt that something better could be done and equally significant that in the end they produced a syllabus which shows no revolutionary changes. The essential problem of bringing all students within the first year up to the homogeneous standard of the Final Honours School is so dominant that it allows for little latitude in the choice of subject matter. Even with the aid of scholarship examinations and special entrance examinations set by the colleges, the entering students differ too much in standard of knowledge to be treated as a homogeneous group in the first year. Thus the task in the first year to achieve equalization of knowledge and practical ability becomes of overriding importance and all other considerations have to take second place. It is, of course, quite impossible under these circumstances to devise a

syllabus which can be of equal value and, what is as important, of the same interest for all students.

Having in the first instance made as good a selection on entry as possible, the first year course must now aim at those who were fairly low in this selection. It is they who will require most attention and for whose needs the syllabus must cater in the first place. This makes it inevitable that the subjects dealt with are those of the ordinary school curriculum. They are being treated in a thorough and fairly consistent manner, and require a full days' work from the student whose physics teaching at school had not been of the highest standard.

To give a rough idea of the limits of this syllabus, I might mention such things as : simple and damped harmonic motion, surface tension and its relation to vapour pressure, viscous flow and Gauss' theorem. They will have to be able to apply the second law of thermodynamics to simple cycles and the thermodynamic temperature scale. In optics they must know something about chromatic aberration and the interference effects in a diffraction grating. Their work in electricity will range from Kirchoff's laws over ion mobility and a.c. circuit analysis to simple electronics, such as applications of the cathode ray oscilloscope.

The striking feature of this first year course is the complete absence of non-classical physics. Such modern developments as atomic structure or nuclear physics are not included. There is equally no mention of the quantum theory or relativity. When this course was, as I mentioned, under review recently, the majority opinion was that the principal aim must remain the acquisition of a sound knowledge of the classical fundamentals and that modern physics should be built up on such a sound structure in the two final years.

There can be no doubt that while Honour Moderations course is of the greatest value and indeed essential for the average student, it is a bit boring and discouraging for the really good pupil with excellent training at school. He can do the work in his stride and often is somewhat disappointed that the university should not offer him anything more stimulating than a glorified repetition of his school work.

In this difficulty the role played by his physics tutor is of great importance. If the tutor is satisfied in his own mind that with the aid of the lectures, practical work and problem classes provided for him his pupil will easily obtain a high class in the examination, he can spend the time of the tutorial in discussion beyond the restricted syllabus. He can answer his pupil's questions on modern physics and guide him into the way of thinking with which the current problems of research will have to be approached. It is up to the tutor of the brilliant pupil to turn the first year from a period of uninspiring and

tedious repetition into fruitful and absorbing introduction into a live and fast moving subject. He can show the student the importance and significance for modern developments of those somewhat dog-eared and moth-eaten laws of classical physics which the latter has to repeat and apply in his first year.

However, a good deal of judgment and strength of character on the part of the tutor are needed if such a course is to be followed. In the end the tutor will be judged by whether or not his pupil was successful in the examination. For him it will always be the safest course to stick to the syllabus and to turn a good pupil into an even better one for the solution of examination problems. This may not be very satisfying for either tutor or pupil, but what if the pupil should be classed low or even fail after a year when the tutor has spent time on interesting generalities instead of on questions of complex impedance and elementary hydrostatics ?

The recent revision of the Honour Moderations syllabus in Oxford and its unspectacular result seem to make it clear that under present conditions the choice of syllabus for the first year cannot be bettered. There is little doubt that the course is, in fact, successful and such criticisms as one has are directed against its tedium rather than against its adequacy.

With the rapid expansion of physics and the growing demand for well-trained physicists the aspect of all physics courses is changing. In the good old days there were fewer things to learn and there was no great pressure towards application. To-day the syllabus is terribly crowded and there is little time left for scholarly contemplation of the subject during the ordinary course. Only those students who enter for a research degree may have some little time left to read and study physics at leisure. And even they are usually worked to capacity with electronics and vacuum testing.

It seems to me that this loss of contemplation in study is a great misfortune. Surely, the taking of a subject at university level should mean that the student should be able to study it in his own way and not by a carefully prepared course of spoon feeding. On the other hand, the great demand for physicists in industry must make us reluctant to keep these students unnecessarily long at the university. Many university teachers now feel quite strongly in favour of a fourth year. Possibly this might be made a preparatory first year at the university. However, for the reasons already mentioned, inhomogeneity of the entry and demand from industry for quick training, it will probably be preferable to add this extra year at the end of the course. This would then give an opportunity for more individual work to those students who wish to avail themselves of it.

Since this conference is mainly interested in the training of physicists, I have said nothing so far about the first year physics course for chemists and engineers and that for students reading medicine, zoology, botany or agriculture. There is indeed ample scope for improvement, particularly in the latter group who are treated to an extremely restricted and antiquated course of study which is dictated by the examination syllabus. If here expert knowledge of the Whimshurst machine and the tangent galvanometer could be replaced by an informed and lucid exposition of the basic principles of physics, these students might remember the subject with better understanding and more profit than they do at present.

II — By S. WEINTROUB, M.A., F.Inst.P.
(*University of Southampton*)

The Institute of Physics last year reported that far too many of those who reach the advanced level of the G.C.E. at school were found at the university to be poorly equipped to begin an honours course in physics and that their most widely agreed deficiencies were their lack of curiosity and their willingness to accept statements without proof or relation to experiment. In fact the examiners marking Advanced level papers have even gone so far as to assert that many candidates know the subject by heart without understanding it. We are not concerned here with determining the reasons for this, whether it is due to the shortage of the abler physics teachers in the schools or to the requirements of the examiners in the G.C.E. examinations, but what we are concerned with is the problem of how best to deal with this inadequately equipped university entrant and how to adapt him as quickly as possible not only to the fresh environment of the university but also to a new approach to his studies and particularly to his physics.

It was W. G. F. Swann who remarked that it is as well to think of physics as comprising two phases, knowledge of facts and knowledge of ideas. The university entrant, straight from school with Advanced level in physics, comes equipped with much factual knowledge but little, if any, knowledge of ideas. It is important that as soon as possible he be given as Professor J. G. Wilson said at the Bournemouth convention " positive encouragement to think for himself and work and plan for himself."* However it is rarely, if at all, that the undergraduate in physics gets a chance to do this. The abler or more fortunate graduate who stays on at the university to do postgraduate research probably gets this positive encouragement ; the research atmosphere, the closer contact with his supervisor and discussions with others of

* " The teaching of fundamentals," *Bulletin*, July 1953, p. 84.

similar standing and the requirements of the Ph.D. degree all force it upon him. But the less fortunate graduate does not get the opportunity and the recent criticisms levelled at physics graduates by their industrial employers are by no means unjustified.

Since, as Sir Charles Morris has recently stated, most people agree that our present degree standards are pitched at the right place, it must be, as in the schools, that the undergraduate teaching and the requirements of the final degree examinations are at fault in that they do not discourage the physics student from continuing merely to accumulate "itemized physics." The content of physics is now too large, and is being added to at too rapid a rate for the student to be expected to obtain, even if it was desirable, within an honours course of three or even an extended course of four years, a detailed knowledge of the mass of developments which now constitute classical and modern physics. True he will need to extend his factual knowledge beyond the elementary stage reached at school, but he must first learn what are the fundamental principles and how to judge for himself, when confronted by fresh material, what of it is important and how much of it it is essential to retain. The university entrant usually has enough factual knowledge to take him through at least the first year of his course. He is well acquainted with the terms that will be used, with most of the experimental methods that will be referred to, and it should be easy at this stage to train him to review his knowledge critically, to show him the textbook is not always right, that different branches of physics are interrelated and involve the same basic principles, that it is just as important, if not more important, to know why a certain thing was done than to know that it was done, and generally to develop and broaden the critical approach. However much of this means going over old ground and unless care is taken the student will consider either that he is wasting time or that it is a dull routine. It is at the beginning of his studies therefore that the student needs the most mature minds to guide him and the most stimulating teachers to lecture and demonstrate to him. Because of this it used to be the custom for the professor or the more senior members of the staff to lecture to the first year students. However, nowadays this is rarely possible ; they are far too much occupied with administrative duties, with the supervision of research students and with research to devote time to the elementary classes. Nevertheless it is the first year student who needs the ablest care and attention. Far too often the lectures are mere repetition of book work and the laboratory classes are run by research students. Even the good university teacher, given large classes and little time to experiment with and modify his material, will

tend to sacrifice the ideal for the more practical and systematize his courses so that the student is left with no uncertainty as to what he is supposed to learn and do. He passes his tests and proceeds further.

How then should the first year course be organized ? The lectures should be given by the most stimulating teachers ; the fundamental principles should be clearly emphasized and much of the material of the factual kind shown to be useful only to illustrate the underlying principles, but not of importance in itself. There should be demonstrations of experiments and apparatus which the students know about but which owing to the limited resources of their schools they have never seen. The demonstrations should not however be of the elegantly finished variety which always work, but should show the physicist, i.e., the lecturer, at work. Close contact between the student and lecturer is also important. It is never too early for the student to learn that physicists, or specialists in any field for that matter, are just as human as the students, but are unusually fond of their subject. It has been said that there is no teaching in physics, there is only inspiration to learn and this spark is most easily generated when there can be adequate discussion between the lecturer and his students. Individual tuition is not advocated but some provision should be made for meetings of the lecturer with small groups of his students.

How to make the laboratory work more effective is a difficult question. It seems reasonable to expect that the actual manipulation of apparatus should interest and benefit the student, especially when the mechanism of every device these days is concealed within a "streamlined cover." It is important that the student gets every opportunity, and does really know how to set up, adjust and handle his apparatus. It is a pity that in so many modern forms the interesting difficulties are very often removed beforehand. Especially to the first year student, nearly every experiment introduces a new piece of apparatus and the student must therefore spend some time at each laboratory session just learning to manipulate the apparatus before he can concentrate on the phenomena involved. The instruction sheets should therefore be brief, avoid theory which is adequately given in the textbook, and leave ample scope for query, discussion and suggestion by the student. In this way the student will gain more interest in his physics, particularly so if, as is often the case, the experiments in the elementary class are ones which he performed perfunctorily at school.

To sum up : the first year requires the best teaching ; stimulation, critical thinking and the careful sorting of the factual knowledge already acquired ; a creation and development of liking for physics. What is taught is not so important as how it is taught.

CORRESPONDENCE

I should be glad if I might reply to Mr. Steels' comments[1] on my review[2] of his book. My main criticism was directed at Chapter II and my comment about " appreciable supplementation and occasional correction " applies particularly to this chapter. In view of the impossibility of giving adequate treatment to mechanics in one chapter, I feel it would have been better to have omitted it altogether. The contents of the book would then have been strictly in accordance with its title. I should add that I am by no means alone in my objection to his treatment of circular motion and the problem has already been discussed by T. A. Grocock (March 1949) in the *School Science Review* XXX, 208. I have already written favourably about the remainder of the book and I feel sure the reviews of more recent work will prove stimulating to teachers of physics.

T. A. LITTLEFIELD.

(1) *Bulletin*, August 1954, p. 176. (2) *Bulletin*, June 1954, p. 139.

NEWS OF MEMBERS

Fellows

J. B. BIRKS has been appointed Research Manager, British Dielectric Research, London.

PROFESSOR L. S. PALMER will be retiring shortly as Professor of Physics, University College, Hull.

R. S. SILVER is now Chief Research Engineer to John Brown Land Boilers Ltd.

DR. S. WHITEHEAD (*Honorary Treasurer*), Director of the Electrical Research Association, has been elected Chairman of the Committee of Directors of Research Associations.

Associates

A. W. AGAR is now a physicist at the Associated Electrical Industries Ltd. Research Laboratories, Aldermaston.

N. H. E. AHLERS has taken up an appointment with Unicam Instruments Ltd., Cambridge.

A. BAIRSTO has been appointed to the staff of the Wigan and District Mining and Technical College.

J. A. BALCHIN is now a physicist at the Lambeth Hospital.

I. DAVIES has been appointed to the staff of the Ewell Secondary School.

W. L. HARRIES has taken up an appointment as Assistant Director of the Research Division, with Transistor Products Inc., Massachusetts.

J. R. MILLS is now a Senior Principal Scientific Officer at the Radar Research Establishment, Malvern.

G. E. OWEN has been appointed physics master at Beaumaris County Secondary School, Anglesey.

K. H. STARK is now at the University, Birmingham.

G. STEPHENSON has been appointed Lecturer in Mathematics at Imperial College.

N. SULLIVAN is now a Design Engineer at the Sperry Gyroscope Company Ltd.

J. C. WILLIAMS is now Works Manager at the Pallion Factory of James A. Jobling & Co. Ltd.

R. L. WOOLLEY has been elected to the chair of physics of the College of Arts and Science, Baghdad.

Graduates

D. E. EARDLEY has taken up an appointment with the Royal Naval Scientific Service as a Senior Scientific Officer.

R. C. SPRAGG has recently joined the Research Staff of Taylor, Taylor and Hobson Ltd.

C. RUBENSTEIN has taken up an appointment with the British Cotton Industry Research Association, Shirley Institute, Didsbury.

REPORTS OF BRANCH AND GROUP MEETINGS

Electron Microscopy Group Conference

From July 16–21 a conference on Electron Microscopy was held at the London School of Hygiene and Tropical Medicine, London, W.C.1, at which the Electron Microscopy Group of the Institute acted as host to the organized Electron Microscopy Groups from abroad. The conference was held under the auspices of the Joint Commission on Electron Microscopy and was organized by a working committee consisting of the committee of the E. M. Group together with those members of the Joint Commission who found it possible to attend committee meetings in London.

In connection with the conference an exhibition was held both of micrographs from research laboratories and also of commercially available apparatus including eight electron microscopes.

Conference members attended a reception given by the University of London on July 15 and a party was entertained by the Royal Microscopical Society on July 20. About 80 members were entertained in the Institute's House on the evening of July 14.

The organizers of the conference are most grateful to all who helped towards the success of the undertaking, particularly the staff of the London School of Hygiene and secretarial staff from the Institute of Physics. C.E.C.

Electronics Group Visit

The Annual Visit of the Electronics Group to an industrial research laboratory took place this year on Friday, July 2, the venue being the Research Laboratories of the Mullard Radio Valve Company at Salfords, near Reigate, Surrey, where at about 11.30 a.m. thirty-five members of the Group were cordially welcomed by Mr. P. E. Trier, the Joint Research Manager. Visitors went first to see the interesting development work being undertaken at the Radar Sonde Station, and then after adjournment for lunch (which quite amply befitted the occasion) were shown, with lucid expositions, further research work in progress at the laboratories, including the Linear Accelerator recently described by Drs. Bareford and Kelliher.

When we dispersed at the end of the afternoon, there could have been few who did not feel that a most enjoyable and profitable day had been spent at Salfords as guests of the Mullard Company, to whom we would like to express our thanks for making this visit possible.

S.R.

ANNUAL CONFERENCE OF BRANCH AND GROUP OFFICERS

The 11th annual Conference of Honorary Officers of Branches and Groups was held at the Institute's House on July 19. The meeting began with luncheon. The first part of the conference consisted of parallel sessions for the Branch officers and Group officers, the former meeting discussing such subjects as choice of lectures and visits and the latter meeting being concerned with matters such as the Group contributions to the next Institute convention and the Institute's policy relating to the publication of conference proceedings. Following these two meetings there was a general conference with Dr. J. Topping in the chair ; among the items discussed were future Institute conferences and conventions, Institute publications, and the Institute's educational work.

A total of twenty-five honorary officers attended.

THE REGISTER

ELECTIONS TO MEMBERSHIP

An asterisk (*) indicates transfer from another grade

Fellows

*Alper, Tikvah, M.A., B.A., Research Physicist, Medical Research Council, Experimental Radiotherapy Research Unit, Hammersmith Hospital, London.

Ardley, Gavin William Rattray, M.Sc., B.A., Senior Master in Physics, Camberwell Grammar School, Melbourne, Australia.

*Darby, John Francis George, B.Sc., Ph.D., Lecturer in Physics, University of Melbourne, Australia.

*Elliott, Edward Rae, B.Sc., Senior Research Physicist, C. A. Parsons & Co. Ltd., Newcastle-on-Tyne.

*Haigh, Clement Percy, B.Sc., Ph.D., Principal Physicist, Bristol Mental Hospital.

*Kaiser, Thomas Reeve, M.Sc., D.Phil., Imperial Chemical Industries, Research Fellow, University of Manchester.

*Lister, William Clarke, B.Sc., Head of Instrument Division, National Institute for Medical Research, Mill Hill.

*Simaika, Yusef Marcus, B.Sc., Inspector General, Nile Control Department, Ministry of Public Works, Cairo, Egypt.

*Winogradoff, Nicholas, B.Sc., Ph.D., Senior Research Physicist, Bexford Ltd., Brantham, Nr. Manningtree, Essex.

Associates

*Burchell, Charles Kasper, B.Sc., Development Engineer, Telephone Manufacturing Co. Ltd., Cray.

Curtis, Lawrence Frederick, B.Sc., Lecturer, Science Department, Stroud and District Technical College.

*Franks, Albert, B.Sc., Ph.D., Scientific Officer, National Physical Laboratory, Teddington, Middlesex.

Hatch, Donald, Research Physicist, Ferodo Ltd., Stockport.

*Hayes, Roy, B.Sc., A.R.C.S., Chief Physicist, British Resin Products Ltd., Sully, Glamorganshire.

*Herbert, Frederick Maitland, B.Sc., Instrumentation Development Officer, Ministry of Supply, London.

*Kelly, Anthony, B.Sc., Ph.D., Research Associate, Department of Mining and Metallurgical Engineering, University of Illinois.

*Laycock, Geoffrey Hugh, B.Sc., Technical Officer, Imperial Chemical Industries Ltd., Stevenston, Ayrshire.

*McQuillan, Charles William, B.Sc., Shop Manager, Ministry of Supply, Division of Atomic Energy (Production), Cumberland.

*Mellors, Harry, B.Sc., Senior Physicist, Central Laboratories, West Midlands Gas Board.

*Milligan, Robert, B.Sc., Lecturer in Physics, The Technical College, Dundee.

Moriarty, William Warren, M.Sc., Research Officer, Commonwealth Scientific and Industrial Research Organization, Victoria, Australia.

Morris, Gwynfryn John, B.Sc., Technical Officer, British Nylon Spinners Ltd., Pontypool, Monmouthshire.

Nixon, Ralph Desmond, B.Sc., Scientific Staff, Research Laboratories, The General Electric Co. Ltd., Wembley, Middlesex.

Oakley, Frank Hadman, B.Sc., Senior Physics Master, Weymouth Grammar School.

Perrens, Donald Frank, M.A., Head of Science Department, Eastbourne College.

Scott, John Robert, B.Sc., Meteorological Officer, Malayan Meteorological Service, Singapore.

*Sherriff, Edna Valerie, M.Sc., Physicist, Commonwealth X-ray and Radium Laboratory, Melbourne, Australia.

Simpson, Raymond Frank, B.Sc., Education Officer, Air Service Training Ltd., Karachi, Pakistan.

Spence, Robert Laurence, B.Sc., Senior Physics Master, Leeds Modern School.

Taylor, Charles Vincent, B.Sc., B.A., Lecturer in Electronic Engineering, Bath Technical College.

Trewin, Frederick Edgar, B.Sc., Assistant Lecturer, Brooklands Technical College, Weybridge, Surrey.

*Wilson, Leonard Gratton, B.Sc., Physicist, Government Chemical Laboratories, Western Australia.

Wright, Gordon Thomas, B.Sc., Ph.D., Lecturer in Physics, Rhodes University, S. Africa.

Graduates

*Crawford, George Ian, B.Sc., Research Student, Dept. of National Philosophy, University of Glasgow.

De Vere, Raymond Harold, B.Sc., Research Student, Metallurgy Department, Battersea Polytechnic, London.

Duggan, Michael John, B.Sc.,

Domleo, Ella Valerie Joyce, B.Sc., Graduate Assistant, Department of Development and Research, T.I. (Group Services) Ltd., Aston.

Godfrey, Thomas William, M.A., Research Officer, The British Boot, Show and Allied Trades Research Association, Kettering.

*Mussett, Edward Anthony, B.Sc., Research Student, Imperial College, London.

Sutton, Brian Watson, B.Sc.,

*Tibbetts, Derek Ross, B.Sc., Assistant Engineer, Standard Telecommunications Laboratories Ltd., Enfield.

Young, Kenneth William, B.Sc., Physicist, Research and Development Department, British Enka Ltd., Aintree, Liverpool.

Four Students and one Subscriber were also elected.

National Coal Board invite applications for superannuable appointments as **scientific technical officers** at their Central Research Establishment II, in Isleworth, Middlesex. The work undertaken is on basic principles and staff are required for the following fields :—1. Problems in the control and improvement of working conditions in mines, 2. mechanical properties of coal of relevance to coal winning, 3. technical methods of coal winning, 4. design of experimental coal-getting machinery, 5. technical problems arising in coal transport, roof support, etc., 6. metallurgy and 7. instrumentation for use in mines and laboratory in connection with the above problems.

It is desirable that candidates should have at least General Certificate of Education at Advanced Level in science subjects or Higher National Certificate in mechanical or electrical engineering or applied physics. Previous experience in laboratory work or instrumentation would be an advantage.

Appointments will be, according to qualifications and experience, as Scientific Technical Officers :—Grade I (scale £730 × £25 – £880) Reference No. TT/816, Grade II (scale £485 × £20 – £705) Reference No. TT/817, Grade III (scale £375 × £20 – £535) Reference No. TT/818. London Location Allowance of £32 10s. 0d. at the minimum rising to £62 per annum at the maximum of the above scales is payable in addition.

Write, giving full particulars (in chronological order) of age, education, qualifications and experience (with dates) to National Coal Board, Establishments (Personnel), Hobart House, Grosvenor Place, London, S.W.1., quoting this paper and marking envelope with the relevant TT reference number quoted above. Original testimonials should not be forwarded. Closing date September 20, 1954.

Crompton Parkinson Limited invite applications from **graduate physicists** or **electrical engineers** with good honours degrees to work in their lamp works development laboratory on general lamp problems. Applicants with or without experience will be considered. Good prospects to a man wishing to make a career in industry. Superannuation scheme to which Company contributes. Send full particulars of education and any practical experience to Ref. LLD, Crompton Parkinson Limited, Guiseley, Nr. Leeds.

Junior physicist required for physical and clinical work with radioactive materials, including research. Salary £565 – £750 a year, superannuation scheme. Applications with names of three referees to Secretary, Institute of Cancer Research, Royal Cancer Hospital, Fulham Road, S.W.3, by September 13, 1954.

A **physical chemist** or **physicist** interested in the properties of matter and in physical chemistry is required by major oil company to work at their Research Centre in the Midlands. The applicant should be interested in industrial research and the subsequent application of research results in practice. The work is connected with the production of crude oil, and there will be good opportunities to proceed to technical posts in operating oilfields in various parts of the world. Applicants should have first or second class honours degree and be under 30 years of age. Good pension scheme. Salary according to age and experience. Write, stating age and full details of qualifications, to Box 6851, c/o 191 Gresham House, E.C.2.

A **physicist** or **electrical engineer** is required to take charge of electrical and mechanical standards room of a well known electronic engineering company in the West London area. Applicants should have appropriate experience of precision measurement of fundamentals and ability to devise precision measuring techniques applicable to the electronic field. The position is a new one and the successful applicant will be largely responsible for the initial organization. Salary from £850 according to qualifications and experience. Please apply with full details in confidence to Box A.V. 66, The Institute of Physics, 47 Belgrave Square, London, S.W.1.

Technical representatives. Tootal Broadhurst Lee Co. Ltd. has one or two vacancies for technical/commercial representatives representing the Company at Home and Overseas. The job combines process investigation and development work with technical servicing of the Company's licensees in the textile finishing industry. This appointment is based on the United Kingdom with opportunities for travel abroad and also provides an excellent entry to an expanding aspect of the commercial field. Men of degree standard in chemistry, physics, chemical engineering or textile technology, aged under 30 and with or without previous industrial/commercial experience, are invited to apply. Applications giving details of age, education, qualifications and experience (if any) to the Personnel Manager, 56 Oxford Street, Manchester, 1.

British Electricity Authority require **third assistant engineer** or **physicist** at the Research Laboratories, Leatherhead. Candidates should have a University degree in electrical engineering or in physics, and some research experience is desirable. Duties include testing, development and research work in the laboratories and in the field in connection with the generation, transmission and distribution of electricity. Salary within N.J.B. Grade 4, £717 – £852 per annum, according to qualifications and experience, rising to a maximum of £934 per annum. Applications stating age, qualifications ,experience and present position and salary to D. Moffat, Director of Establishments, Winsley Street, London, W.1, to be received by September 10, 1954. Please quote ref. BIP/501.

Bakelite Limited have a vacancy at their Aycliffe (Co. Durham) works for a young **chemist** or **physicist.** Applicants should have a B.Sc. degree or equivalent, and some industrial experience. The work is concerned with the physical testing of plastics. Salaries will be in the range of £650 – £850 per annum in accordance with age and experience. Applications should be addressed to :—The Personnel Manager, Bakelite Limited, 12 Hobart Place, London, S.W.1

Monmouthshire Education Committee
Technical College of Monmouthshire, Cramlin.

Applications are invited for the post of **assistant lecturer** in physics at the above college.

Candidates must possess a good honours degree in this subject and it is desirable that they should have had research and/or industrial and teaching experience. Salary in accordance with the Burnham Technical Scale for Assistants Grade " B."

Forms of application, obtainable from the undersigned, must be returned not later than September 20, 1954.

County Hall,
Newport,
Monmouthshire.

C. E. Gittins,
Director of Education.

Physicist required to join team engaged on operational studies of papermaking machine and evaluation of pulps. Good honours degree necessary and an interest in classical physics and statistical analysis. Salary (£525–£575). Post is permanent and pensionable under F.S.S.U.

Apply, The Director, The British Paper and Board Industry Research Association, St. Winifred's, Welcomes Road, Kenley, Surrey.

University of New England, Armidale, New South Wales. Applications are invited for the position of **senior lecturer in physics.**

Other things being equal, preference will be given to applicants with a good knowledge of classical theoretical physics and Quantum Theory.

Commencing salary will be within the range of £A1500 to £A1750 per annum according to qualifications, with annual increments of £A50. The salary is subject to deductions under the State Superannuation Act.

The successful applicant will be expected to take up duties as soon as can be arranged after the date of appointment. Further particulars and information as to the method of application may be obtained from the Secretary, Association of Universities of the British Commonwealth, 5 Gordon Square, London, W.C.1.

The closing date for the receipt of applications, in Australia and London, is October 18, 1954.

Graduate physicist required for experimental investigations. The vacancy is on the staff of the central research laboratory of a large group of companies, but the successful candidate will also be required to carry out works' investigations. Applications, giving full details in writing, should be made to the Director of Research, G.K.N. Group Research Laboratory, Birmingham New Road, Lanesfield, Wolverhampton.

Director of Research. The British Steel Castings Research Association, with Headquarters in Sheffield, invites applications for the post of Director of Research, to lead a team of about 18 scientists and technicians, together with clerical and library services. A metallurgist with research and some industrial experience preferred, but a physicist or chemist with similar experience considered. A new research station is about to be built and equipped. The Association is in receipt of D.S.I.R. Grant, and has connections and liaison with the works and laboratories of all the leading steel foundries in the U.K., together with a number of overseas contacts. For this reason administrative ability to work with committees, works personnel etc., as well as the Association's own staff is of great importance. Salary, which will be in accordance with qualifications and experience, will be substantial. The Industry served by the Association produces about 225,000 tons per annum of carbon and alloy steel castings, and employs approximately 25,000 people.

Communications or queries should be addressed in confidence to the Chairman, British Steel Castings Research Association, Broomgrove, Lodge, Sheffield, 10.

European Council for Nuclear Research, Geneva, has a number of vacancies for high grade **research physicists** and **electronic engineers** to assist in the design and construction of high-energy accelerating machines for nuclear research. Other posts for research physicists in fundamental high-energy nuclear research will also be available later. The posts, in varying grades up to Group Leader, carry a salary range from 17,000 to 29,000 Swiss francs tax free per annum. First-class qualifications and experience essential. For further information and application forms write to the Secretary, Ministry of Labour and National Service, Almack House, 26 King Street, London, S.W.1, quoting AS12/CERN.

Physicist, male, age about 30, Ph.D. or equivalent status, with experience in vacuum technique, required at the **Wellcome Research Laboratories, Beckenham,** for development and control of freeze-drying of biological products.

Salary according to previous experience. Applications to Director, Wellcome Research Laboratories, Langley Court, Beckenham.

British Celanese Limited have a vacancy in the Woven Production and Development Laboratory at Head Office for a young **graduate physicist** for textile testing and development work. This is an interesting appointment for a man of good personality with a real desire to make a career in textiles. No previous experience is necessary but ability to lecture and be effective in committee work is essential. Applicants should send details of age, experience, qualifications etc., to Personnel Manager, 22 Hanover Square, W.1.

Imperial Chemical Industries Limited, Plastics Division, wish to fill two vacancies in their **instrument department** at Welwyn Garden City.

The first appointment carries Technical Officer status and minimum qualifications are an honours degree (physics or engineering) with experience of industrial instrumentation and automatic control. Some knowledge of electronics would be useful. The selected candidate would be employed initially on instrument maintenance in connection with research and semi-technical and plastic plants.

The second appointment is of Assistant Technical Officer status and the minimum qualification is a pass degree in physics or engineering (or its equivalent). Experience in experimental physics, instrument design or electronics would be an advantage. The work is concerned with the design and/or application of instrumentation for measurement and control in chemical and plastics plants.

Good starting salaries will be paid, beyond which there is scope for progressive remuneration. Apply giving full particulars to the Staff Manager, I.C.I. Limited, Plastics Division, Black Fan Road, Welwyn Garden City, Herts.

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